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Anatomic relationship between trigeminal nerve and temporomandibular joint

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Abstract. – Temporomandibular joint disorders (TMD) is a collective term used to describe pathologic conditions involving temporomandibular joint (TMJ), masticatory muscles and associated structures.

Common related complaints include local pain, limited mouth opening and TMJ noises whereas symptoms often associated to TMD with debated pathogenesis enclose earache, headaches, tinnitus and trigeminal-like symptoms such as atypical orofacial pain.

In particular, TMD trigeminal associated symptoms are intricate, difficult to treat and exert a great impact on everyday life of the patients thus invoking a complex multidisciplinary treatment.

In this paper, the authors analyze the anatomic and topographic relationships between the mandibular branch of the trigeminal nerve and the medial aspect of the TMJ capsule in 8 fresh adult cadavers thus resuming a pathologic relationship between atypical trigeminal symptoms and TMD.

Key Words:

Trigeminal nerve, Temporo-mandibular joint, Relations, Anatomic relations, Pathologic relations, Fresh cadavers dissection, Temporo-mandibular disorders.

Introduction

Temporomandibular joint disorders (TMD) is a collective term used to describe pathologic conditions involving temporomandibular joint (TMJ), masticatory muscles and related structures. There are three cardinal symptoms: pain in the preauricular region, limited mouth opening and TMJ noises[1].

This cardinal triad is nowadays characterized by having a well established pathologic relationship with TMD. Nevertheless, other common complains with uncertain pathogenesis are often associated with TMD, such as earache, headache tinnitus and atypical trigeminal symptoms[2,3].

Particularly, TMD trigeminal related symptoms are complex, difficult to treat and have a great impact on everyday life of the affected patients thus suggesting a compound multimodal and multidisciplinary treatment.

James B. Costen[4], in 1934, was the first to depict a syndrome related to TMD in enclosing all toghtether signs and symptoms such as perceived hearing loss, stuffy sensation in the ears, pain in the ear region, tinnitus, dizziness, sinusitis-like pain, burning sensation in the throat and tongue, headache, trismus as well as transient paresthesia in the region of the mandibular nerve.

According to the author's hypothesis, the lack of posterior support of the alveolar ridge led to mandibular vertical height loss which caused a slipping backward of the condyles over the articular disc thus resulting in TMJ discal damage, erosion of the glenoid fossa bone, compression of the Eustachian tubes and tympanic plates and consequent impingement of the auriculotemporal nerve (ATN), which runs on the postero-medial aspect of the TMJ capsule, and chorda tympani nerve[4].

Costen's theory was soon criticized since the first years of the 50's when Sicher[5] and afterwards many Authors argued on it. As a consequence, Costen's hypothesis lost support and TMD became a multifactorial disease dealing with complex pathogenesis and physiopathology[6-9].

Nevertheless, this theories did not give a definitive answer to this complex series of clinical manifestation and TMD syndrome still remains debated.

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In this study the Authors analyse the anatomic and topographic relations between the mandibular branch of the trigeminal nerve and the medial aspect of TMJ capsule in 8 adult fresh cadavers, thus resuming a pathologic relationship between atypical trigeminal symptoms and TMD.

The study was approved by the local Ethical Committee

Materials and Methods

Eight fresh adult cadavers were dissected for this study for an average total number of sixteen TMJs. For the dissection of the TMJ medial aspect, the following technique was been performed for each side:

- Preauricular incision extended to the superior aspect of the temporal region;
- TMJ capsule and related structures exposal together with the mandibular ramus and the sigmoid notch;
- Mandibular ramus osteotomy from the mandibular angle to the sigmoid notch aimed to expose the infratemporal fossa thus identifying the exit of the IIIrd branch of the trigeminal nerve at the level of the middle cranial base (foramen ovalis).

Once performed the anatomic dissection, the mandibular nerve was followed from its origin to the medial aspect of the TMJ capsule.

After either condyle or TMJ capsule removal, some measurements were performed, which were:

- Average distance between the medial aspect of the glenoid fossa and the lateral border of the foramen ovalis;
- Average distance between the ATN and the medial aspect of the posterior and superior region of the TMJ.

Results

In all the 16 dissected joints, the mandibular nerve resulted as running closest to the anterior and the medial region of TMJ capsule. The av-

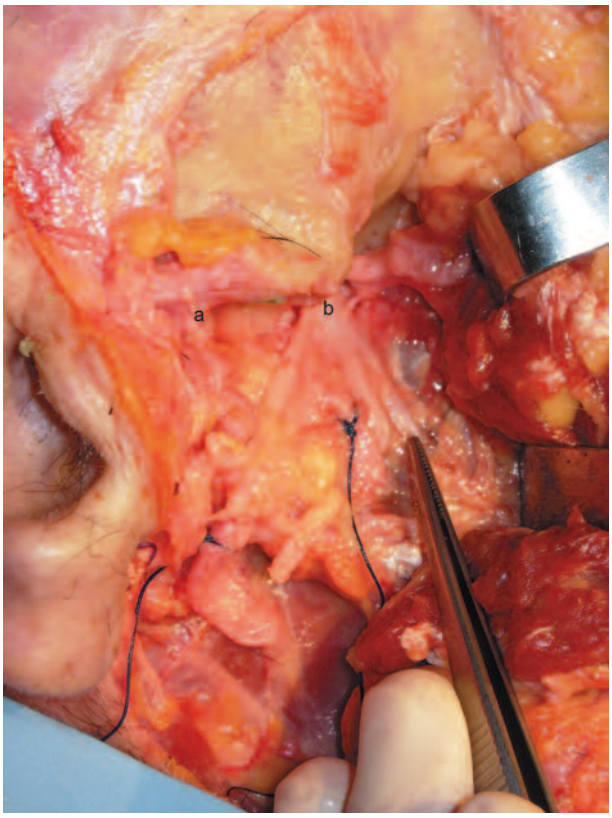

Figure 1. Relation between trigeminal nerve emergence (*b*) and TMJ. (*a*) Glenoid fossa.

erage distance between the medial aspect of the TMJ capsule and the foramen ovalis resulted 10.3 ± 2.8 mm with no significant differences for both sides of each anatomic subject.

Moreover, according to International Literature[10-12], NAT resulted as placed between the medial aspect of the TMJ capsule and the medial border of the glenoid fossa. At this level, the nerve lied on the posterior and inferior border of the lateral pterygoid muscle and the horizontal distance resulted 0 mm in all the dissected joints, whilst the vertical distance accounted for 6.06 ± 2.12 mm.

Discussion

In 1934, J.B. Costen[4] was the first to describe a TMD related syndrome enclosing atypical trigeminal symptoms. Although Costen was acclaimed for bringing the significant role of the TMJ into the realm of awareness of physicians and dentists alike, he was soon judged by many to have been naïve in his espousal of the range of symptoms arising from TMD, in his anatomical explanations and, above all, in his view of the pivotal role of malocclusion even due to opponent anatomic series which showed that the posterior course of the auricolotemporal nerve did not lead itself to condylar compressions.

Nowadays, TMD is considered as a syndrome with complex pathogenesis and physiopathology with many risk factors but no real causes.

On the basis of this study, it would not be inconsistent to suppose that the anatomic relationships between NAT, mandibular nerve and the medial aspect of the TMJ might play an important role in the atypical trigeminal symptoms onset[12,13].

This could occur even more when an anteromedial disc displacement would shorten the average distance between the medial aspect of the TMJ and the trigeminal nerve, thus provoking either NAT or mandibular nerve impingement and symptoms onset in predisposed subjects. In fact, as already stated in other studies regarding otologic symptoms related to TMD[2,14], the often invoked heterogeneity of symptoms could be depend on an individual neural mediated predisposition, acting as a modulating factor at the level of the central nervous system (CNS).

Conclusions

Over the years, many theories analyzing the complex series of symptoms related to TMJ were developed. Nevertheless, currently, no definitive evidence is available and hypotheses are still debated[15-17].

This study shows that mandibular nerve is closest to the TMJ capsule, particularly at its anterior and medial aspect.

At this level, an irritating or compressive occurrence acting on the mandibular nerve might cause trigeminal-like symptoms even extended to the entire orofacial region which could even chronicize at CNS level for some predisposed subject.

We believe that the future investigations should consider *in-vivo* series on mandibular nerve involvement in TMD atypical manifestations pathogenesis even taking into consideration a pharmacological combination for chronic TMD patients in which a reverberant stimulus might be established.

Thus, only a modern evidence-based multimodal and multitasking approach involving different specialties dealing with cranio-facial district could give a concrete contribution to diagnosis and treatment of TMD syndrome.

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